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(54) **SIDE ADJUSTABLE DOOR HINGE PIN SOCKET MECHANISM**

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E05F 1/12	(2006.01)
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(52) **U.S. Cl.**

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USPC **16/301**; 16/236; 16/240

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USPC 16/301, 300, 299, 298, 235, 236, 237, 16/238, 239, 240, 241, 242, 243, 244, 245, 16/246, 249, 308; 49/386

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

998,692	A *	7/1911	Keene et al.	16/300
1,056,171	A *	3/1913	Henry	16/242
1,105,852	A *	8/1914	Sherwood	16/285
3,040,434	A	6/1962	Yarosz	
3,339,225	A *	9/1967	Booth	16/300
3,858,320	A	1/1975	Neal	
4,646,472	A *	3/1987	Sugawara	49/386
4,696,078	A	9/1987	Stromquist	
4,905,347	A *	3/1990	Wroth	16/308
5,074,609	A *	12/1991	Dear	296/76
5,265,954	A	11/1993	Keil	
5,321,870	A *	6/1994	Wada et al.	16/300
5,333,355	A *	8/1994	Beswick et al.	16/300
5,392,493	A *	2/1995	Youngdale	16/237
5,967,586	A *	10/1999	Duffy et al.	296/76
6,978,516	B1 *	12/2005	Calderon et al.	16/235
7,240,400	B2 *	7/2007	Bonham	16/238
7,334,293	B2 *	2/2008	Erickson et al.	16/243
7,552,511	B2 *	6/2009	Campbell et al.	16/238

(Continued)

OTHER PUBLICATIONS

International Search Report and Written Opinion issued on Jul. 30, 2013 in related PCT/US2013/038080 application.

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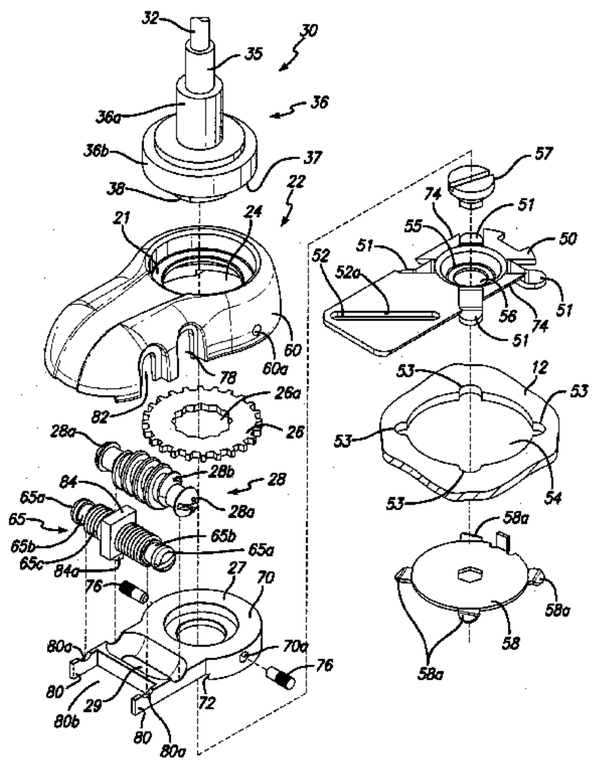
(57) **ABSTRACT**

A device for use in a door assembly that is positioned in a cabinet and defines a pivot axis. The device includes a base member adapted to be fixedly secured to the cabinet, an intermediate member slidingly engaged with the base member, and a cover connected to the intermediate member and having a hinge pin socket therein. The intermediate member includes a transversely extending adjustment screw associated therewith that defines a first axis. Rotation of the adjustment screw causes the intermediate member and cover to move in a direction substantially perpendicular to the first axis.

8 Claims, 6 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,694,389	B2 *	4/2010	Erickson et al.	16/243
8,388,077	B2 *	3/2013	Park	312/405
2004/0200035	A1 *	10/2004	Fries	16/238
2005/0120517	A1 *	6/2005	Bonham	16/238
2006/0179610	A1 *	8/2006	Erickson et al.	16/243
2007/0143959	A1 *	6/2007	Chung	16/236
2008/0209679	A1 *	9/2008	Erickson et al.	16/245
2008/0271291	A1 *	11/2008	Chen et al.	16/238
2008/0307606	A1 *	12/2008	Karlsson	16/243
2009/0089974	A1 *	4/2009	Fries et al.	16/243
2010/0242227	A1 *	9/2010	Tagtow et al.	16/237
2012/0167342	A1 *	7/2012	Wu et al.	16/239

* cited by examiner

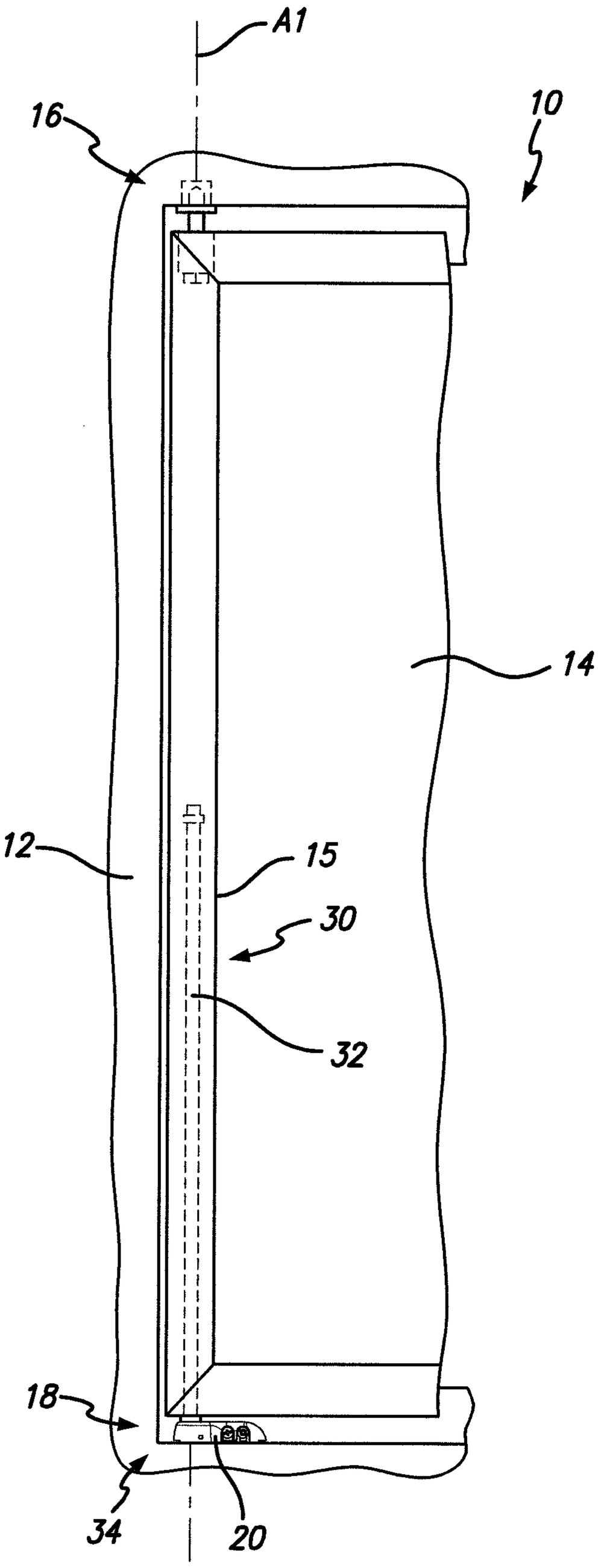


FIG. 1

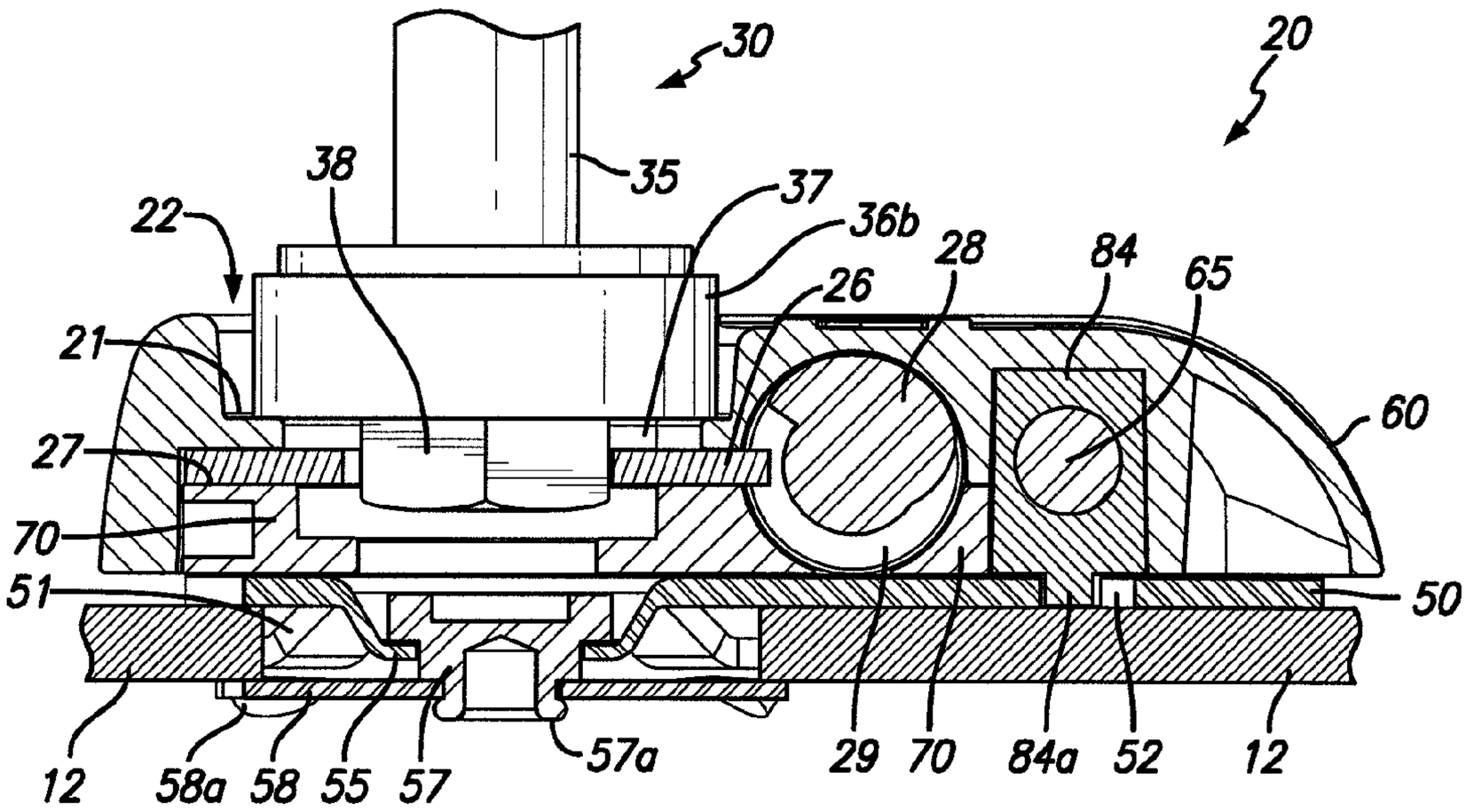

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FIG. 2

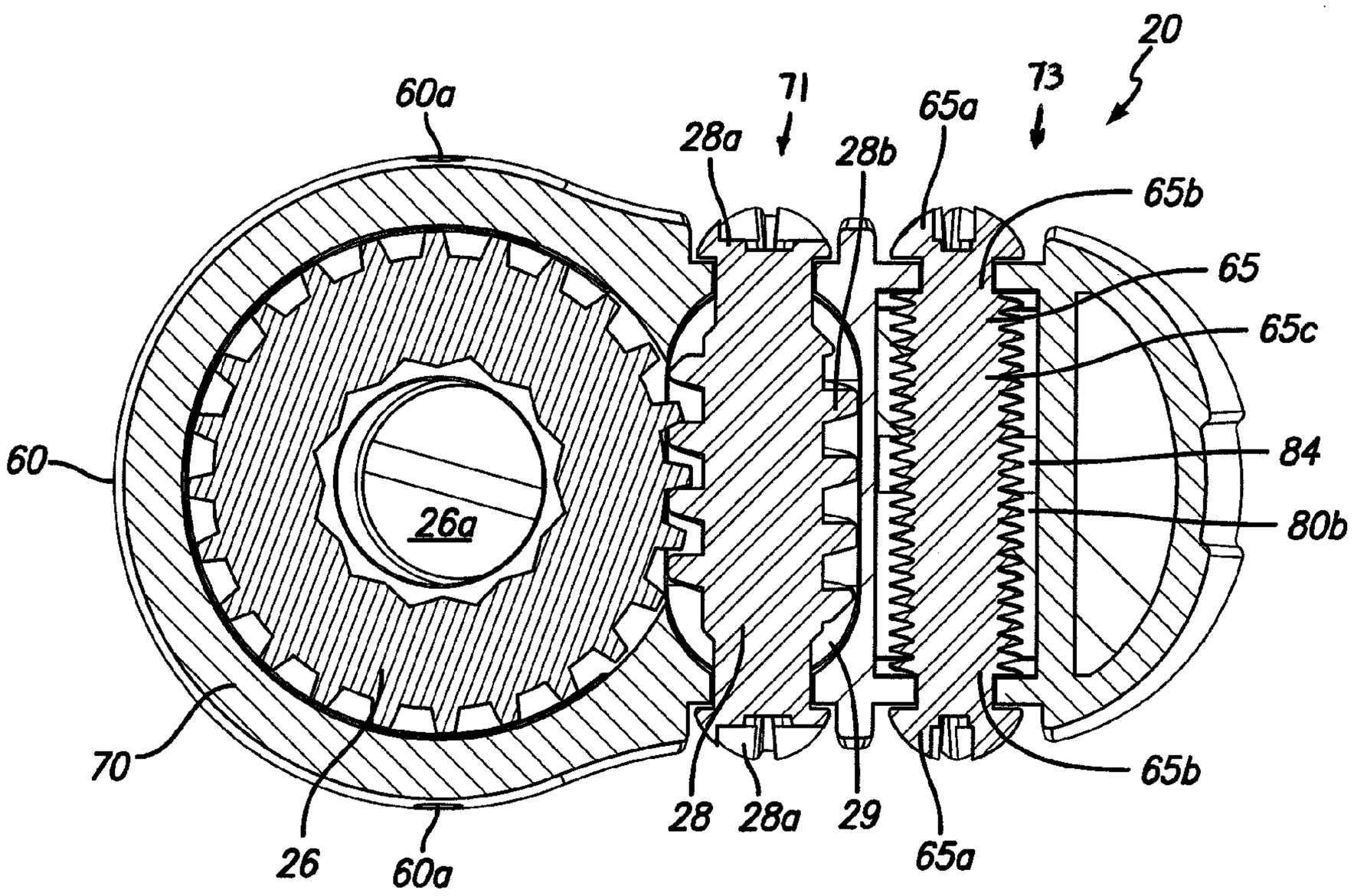
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FIG. 3

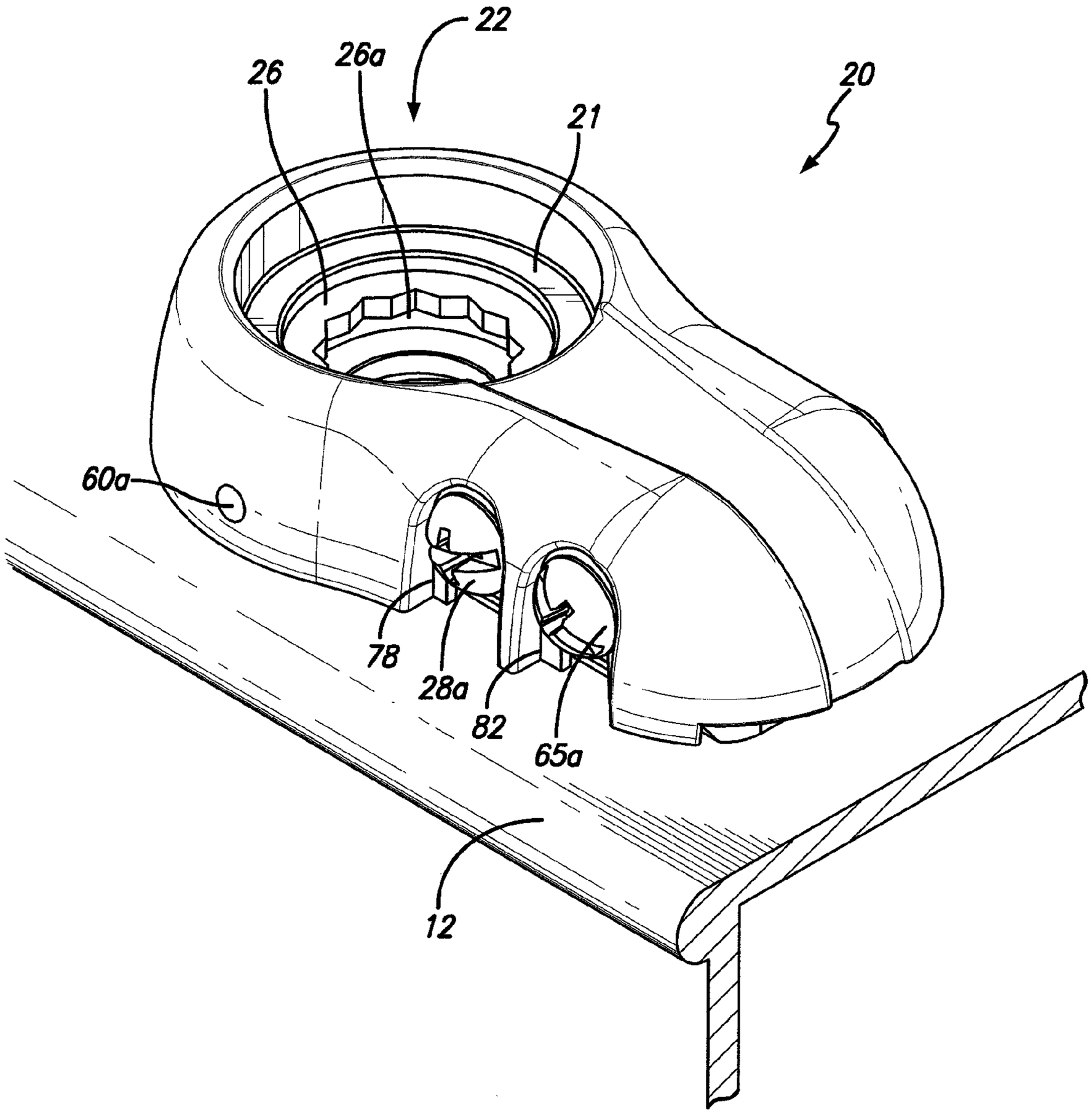

FIG. 4

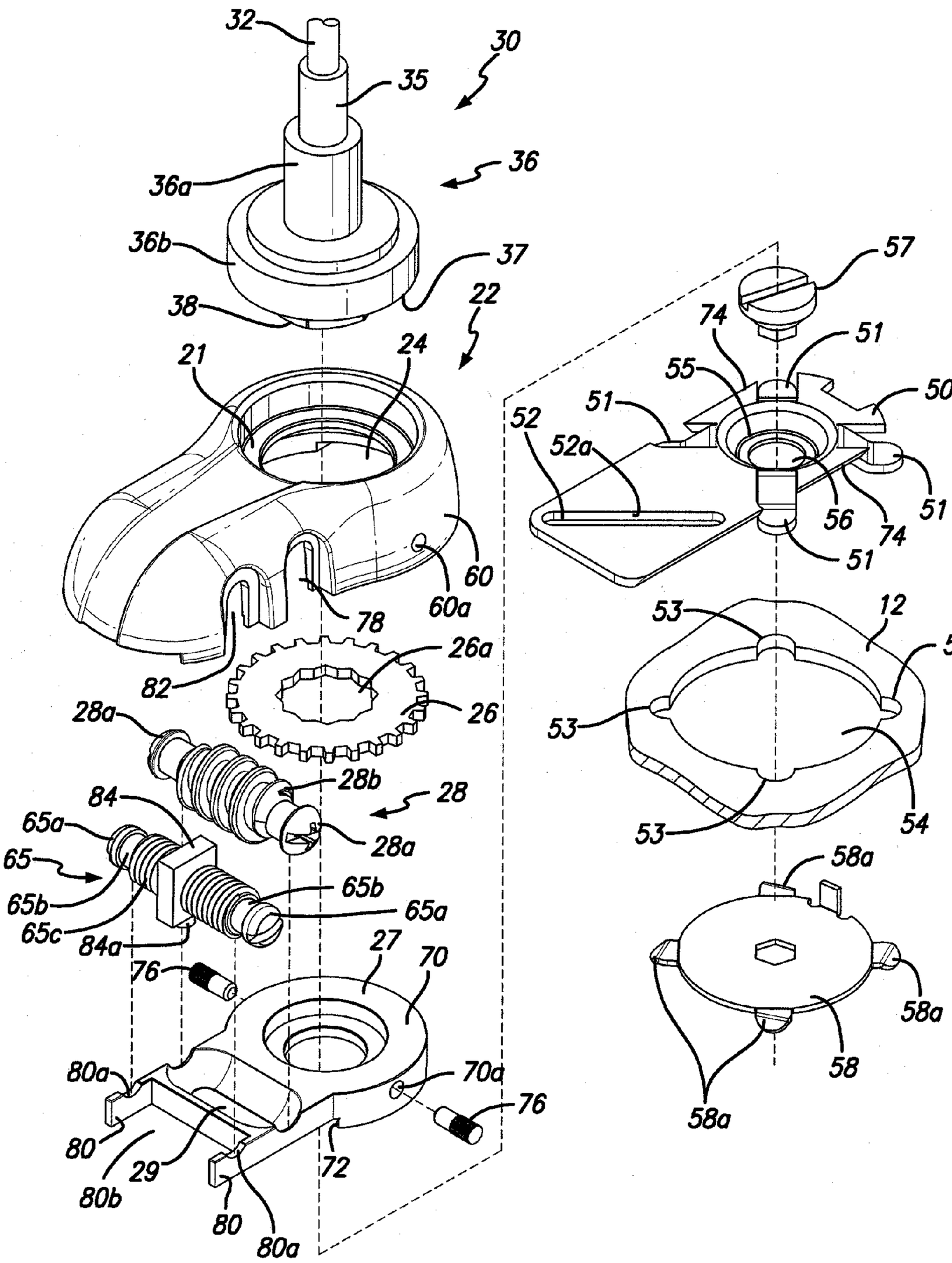
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FIG. 5

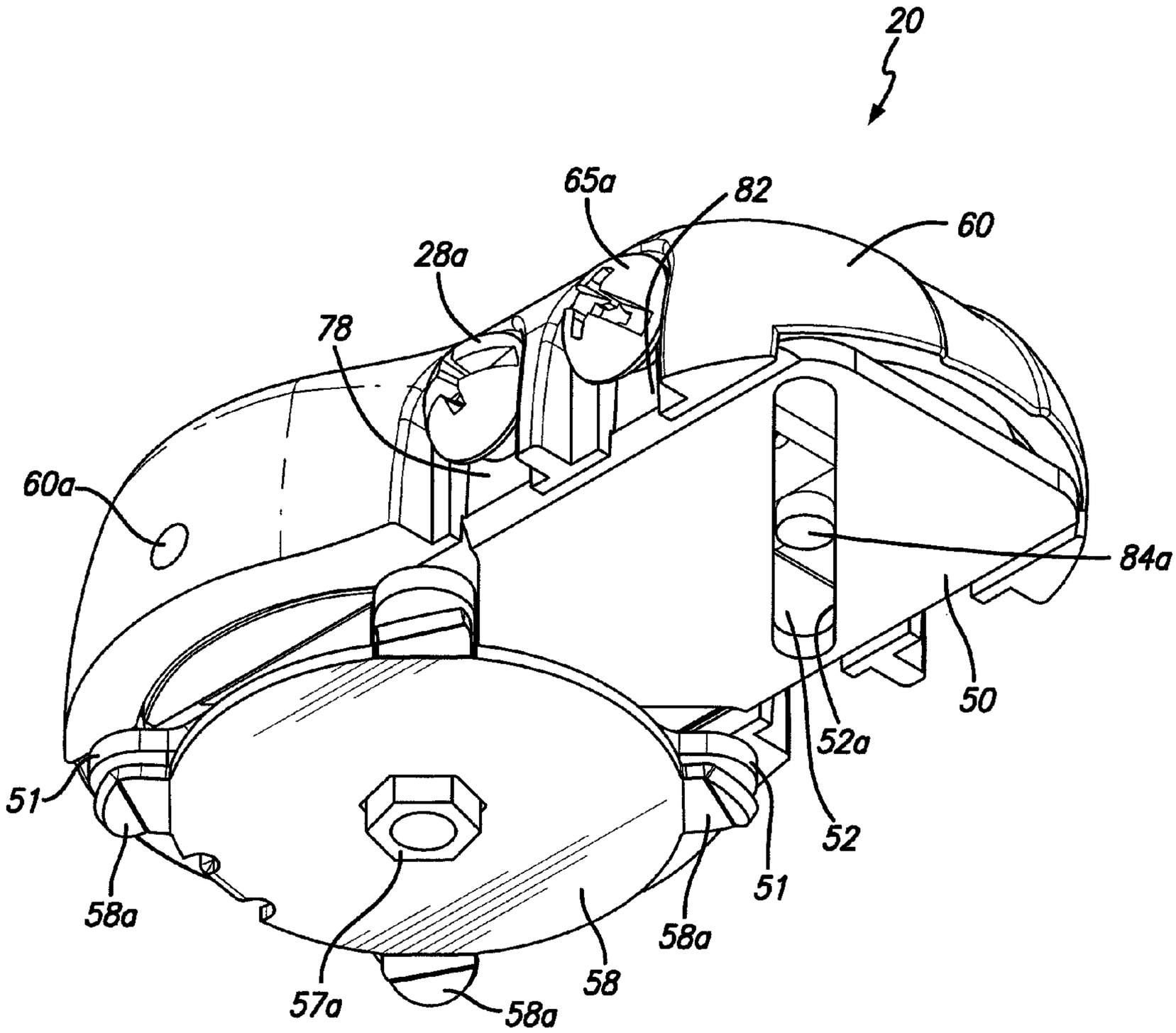

FIG. 6

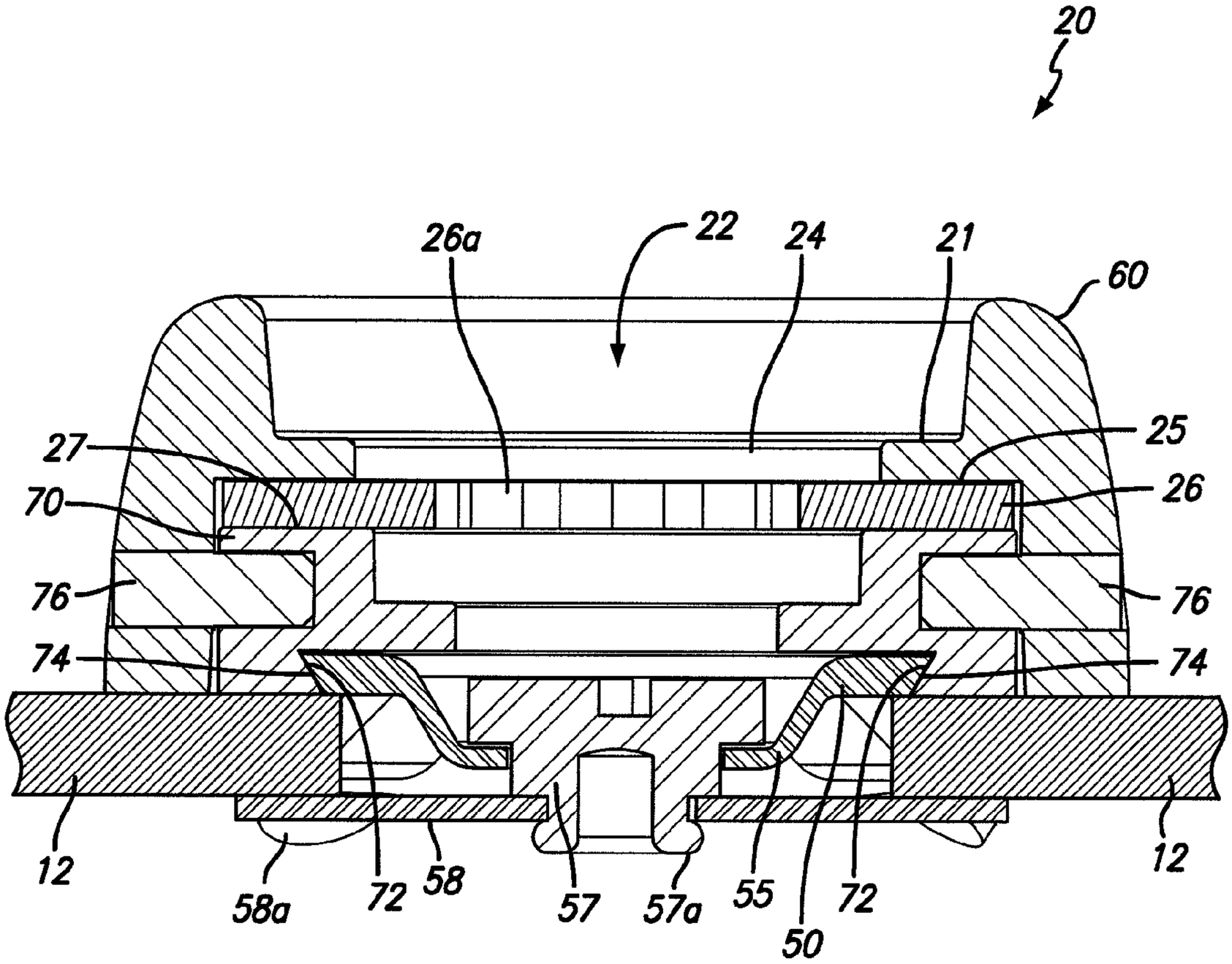
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FIG. 7

SIDE ADJUSTABLE DOOR HINGE PIN SOCKET MECHANISM

FIELD OF THE INVENTION

The present invention relates generally to refrigerated display cases and refrigerator doors and, more particularly, to a refrigerator door used in grocery stores.

BACKGROUND OF THE INVENTION

The present invention provides a mechanism for applying a varying amount of torque to a fixed external torque and that allows for side to side adjustability of the mechanism when affixed to a stationary base. A prior art device is taught in U.S. Pat. No. 4,696,078 to Stromquist, the entirety of which is incorporated by reference. The present invention improves upon the functionality of the device taught in the '078 patent by changing the placement of the side to side adjustment from the end of the device to the side of the device and changing the internal mechanism to provide such adjustment. The present invention allows for adjustment of door sag while the door remains closed.

Commercial refrigerator doors are often equipped with a torsion spring housed in a device that helps ensure automatic closing of the refrigerator door to keep the cold air in the display case. The device houses the torsion spring, provides easy torque adjustment to ensure door closure at smaller openings and door sag adjustment for squareness of the door within the frame during and post installation. The device taught in the '078 patent requires adjustment on the end of the device or on the side with respect to the case (as opposed to the front).

SUMMARY OF THE PREFERRED EMBODIMENTS

In a preferred embodiment, the side adjustable torque application mechanism includes a worm gear and a sprocket for clock-wise and counter clock-wise rotation of the torque rod seated in the mechanism. The door closing torque is adjusted using a rotatable worm gear and associated components and sag adjustment is provided by a sag adjust screw. In a preferred embodiment, the double headed sag adjust screw is captured in a peg nut, which is captured by a boss within the angular slotted plate. As the screw turns, the peg nut traverses front to back moving the slotted plate side to side, thus moving the housing side to side, with respect to the door.

In accordance with a first aspect of the present invention there is provided a device for use in a door assembly that is positioned in a cabinet and defines a pivot axis. The device includes a base member with a diagonally oriented slot defined therein and that is adapted to be fixedly secured to the cabinet, an intermediate member slidingly engaged with the base member, and a cover connected to the intermediate member. The intermediate member includes a transversely extending adjustment screw associated therewith that defines an axis and has at least one head and a threaded portion with a peg nut thereon that includes a boss extending downwardly into the diagonally oriented slot of the base member. The cover has a hinge pin socket therein and includes an opening defined therein through which the head of the adjustment screw extends. In a preferred embodiment, the adjustment screw includes two non-threaded portions positioned axially on either side of the threaded portion that are each seated in an indentation defined in the intermediate portion. Preferably, the adjustment screw includes a head on each end thereof, and

the cover includes openings on each side thereof through which one of the heads of the adjustment screw extends. In a preferred embodiment, the intermediate member and base member comprise mating angled surfaces that prevent the intermediate member from moving upwardly and that allow the intermediate member and cover to slide in a direction substantially perpendicular to the axis defined by the adjustment screw.

In a preferred embodiment, the device further includes a worm wheel rotatively housed in the cover and having a central aperture adapted to matingly receive the end of a torque rod of the door assembly in a non-rotative relationship, and a worm housed by the cover in engaging relationship with the worm wheel and adapted to be selectively turned so as to adjust the torque of the torque rod. Preferably, the worm is seated in a channel defined in the intermediate member.

In accordance with another aspect of the present invention there is provided a device for use in a door assembly that is positioned in a cabinet and defines a pivot axis. The device includes a base member adapted to be fixedly secured to the cabinet, an intermediate member slidingly engaged with the base member, and a cover connected to the intermediate member and having a hinge pin socket therein. The intermediate member includes a transversely extending adjustment screw associated therewith that defines a first axis. Rotation of the adjustment screw causes the intermediate member and cover to move in a direction substantially perpendicular to the first axis. In a preferred embodiment, the device also includes a torque adjustment mechanism that is adapted to adjust the torque of a torque rod of the door assembly. Preferably, the torque rod adjustment mechanism includes a worm wheel and a worm that is rotatable about a second axis that is substantially parallel to the first axis.

In accordance with another aspect of the present invention there is provided a method of adjusting the position of a pivot axis of a door that includes a torque rod having a bottom end positioned in or otherwise associated with a hinge pin socket adjustment device. The method includes rotating an adjustment screw in the hinge pin socket adjustment device. When the adjustment screw is rotated, it rotates about a first axis and the pivot axis of the door moves in a direction substantially perpendicular to the first axis. In a preferred embodiment, the door is positioned in a cabinet and the hinge pin socket adjustment device includes a base that is secured to the cabinet. When the adjustment screw is rotated, the adjustment screw moves in a direction substantially perpendicular to the first axis. The hinge pin socket adjustment device includes an intermediate member slidingly engaged with the base member. The adjustment screw is supported by the intermediate member. In a preferred embodiment, the method further comprises the step of rotating a worm in the hinge pin socket adjustment device to adjust the torque of the torque rod. The worm defines a second axis that is substantially parallel to the first axis.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a partial elevation view of a refrigerator door showing the installed side adjustable torque application mechanism of the present invention;

FIG. **2** is a side sectional elevational view of the side adjustable torque application mechanism of FIG. **1**;

FIG. **3** is a bottom sectional plan view of the side adjustable torque application mechanism of FIG. **1**;

FIG. **4** is a perspective view of the side adjustable torque application mechanism of FIG. **1**;

FIG. **5** is an exploded view of the side adjustable torque application mechanism of FIG. **1** in association with the end of a torque rod assembly;

FIG. **6** is a bottom perspective view of the side adjustable torque application mechanism of FIG. **1**; and

FIG. **7** is a front sectional elevational view of the side adjustable torque application mechanism of FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description and drawings are illustrative and are not to be construed as limiting. Numerous specific details are described to provide a thorough understanding of the disclosure. However, in certain instances, well-known or conventional details are not described in order to avoid obscuring the invention. References to "one" or "an" embodiment in the present disclosure can be, but are not necessarily references to the same embodiment; but, such references mean at least one of the embodiments.

Reference in this specification to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment of the disclosure. The appearances of the phrase "in one embodiment" in various places in the specification are not necessarily all referring to the same embodiment, nor are separate or alternative embodiments mutually exclusive of other embodiments. Moreover, various features are described which may be exhibited by some embodiments and not by others. Similarly, various requirements are described which may be requirements for some embodiments but not other embodiments.

The terms used in this specification generally have their ordinary meanings in the art, within the context of the disclosure, and in the specific context where each term is used. Certain terms that are used to describe the disclosure are discussed below, or elsewhere in the specification, to provide additional guidance to the practitioner regarding the description of the disclosure. For convenience, certain terms may be highlighted, for example using italics and/or quotation marks: The use of highlighting has no influence on the scope and meaning of a term; the scope and meaning of a term is the same, in the same context, whether or not it is highlighted. It will be appreciated that the same thing can be said in more than one way.

Consequently, alternative language and synonyms may be used for any one or more of the terms discussed herein. Nor is any special significance to be placed upon whether or not a term is elaborated or discussed herein. Synonyms for certain terms are provided. A recital of one or more synonyms does not exclude the use of other synonyms. The use of examples anywhere in this specification including examples of any terms discussed herein is illustrative only, and is not intended to further limit the scope and meaning of the disclosure or of any exemplified term. Likewise, the disclosure is not limited to various embodiments given in this specification.

Without intent to further limit the scope of the disclosure, examples of instruments, apparatus, methods and their related results according to the embodiments of the present disclosure are given below. Note that titles or subtitles may be used in the examples for convenience of a reader, which in no way should limit the scope of the disclosure. Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this disclosure pertains. In the case of conflict, the present document, including definitions, will control.

It will be appreciated that terms such as "front," "back," "top," "bottom," "side," "short," "long," "up," "down," and "below" used herein are merely for ease of description and refer to the orientation of the components as shown in the figures and are not intended to be limiting.

Referring to FIG. **1**, there is shown a conventional commercial refrigerator door assembly **10** with the torque rod adjustment and hinge pin socket device or side adjustable torque application mechanism **20** of the present invention installed. It will be understood that by "side adjustable" it is meant the side of the device **20**, which faces the outside of the display case. As shown in FIG. **1**, this provides adjustability from the front of the door/cabinet. Also, the device **20** is reversible and provides adjustment from both sides (from the front or the back with respect to the door/cabinet). The door assembly **10** comprises a cabinet **12** having a top horizontal frame member, a bottom horizontal frame member, and two side frame members, only the left cabinet frame member appearing complete in the fragmentary view of FIG. **1**. The door assembly **10** also comprises the door **14** with its peripheral frame **15**.

Shown at the top of FIG. **1** is a conventional door hinge assembly **16**, wherein a hinge pin is fixedly secured to the door **14** and protrudes upwardly, and is received by a hinge pin socket disposed and fixed in the top horizontal frame member of the cabinet **12**. Shown at the bottom of FIG. **1** is the lower door hinge assembly **18**, whose differences from the conventional door hinge will be described hereinafter. The upper door hinge assembly **16** and the lower door hinge assembly **18** together define the door's pivot axis A1 about which the door swings.

Also present in the door assembly **10** of FIG. **1** is a torque rod assembly **30** which is conventional in all respects except for the features to be described hereinafter. The torque rod assembly **30** serves to provide a biasing force which is used to close the door **14** when it is released in the open position and bias it to maintain the door in the closed position. The torque rod assembly **30** (also see FIG. **5**) comprises the torque rod **32**, a torque rod anchor member integral with the door **14** and housed within the side door frame **15**, and a torque rod anchor **34** secured to the lower horizontal structural member of the cabinet **12**.

The upper end of the torque rod **32** has a non-circular shape (e.g. key shape) which is matingly received and secured in a mating aperture (e.g. key hole) in the upper torque rod anchor. This secure attachment prevents relative rotation between the upper end of the torque rod **32** and the door **14**. It will be understood that the hinge assemblies and associated components and the torque rod assembly are not a limitation on the present invention and that other types of hinge assemblies, e.g., an electrical hinge pin assembly can be used.

Turning now to FIGS. **2-5**, and in particular to FIG. **5**, there is shown a preferred embodiment of the present invention. This embodiment is intended for use as the bottom pivot point of the door, although it will be appreciated by those skilled in the art that it could be used as well as the top pivot point of the door.

FIG. **5** is an exploded view of a preferred embodiment of the invention. The torque rod assembly **30** as shown in the preferred embodiment comprises a torque rod **32**. The torque rod **32** may be, for example, of selected spring steel of high fatigue resistance and which retains its torsional resiliency during many years of use when forcibly twisted through an arc of 90° or more. A sleeve **35**, preferably plastic, loosely surrounds the rod **32** for essentially the entire length of the rod **32**. This sleeve **35** protects the rod **32** from contacting other components in the door and facilitates its operation. Disposed

near the end of the torque rod **32** is a hinge pin **36** which comprises a cylindrical sleeve portion **36***a* and an integral enlarged shoulder portion **36***b*. A circular orifice runs through the middle of the hinge pin **36** through which the torque rod **32** freely passes. The hinge pin **36** functions as follows, the sleeve portion **36***a* is disposed in and is free to rotate within an aperture in the bottom side of the door frame **15**, and the enlarged shoulder **36***b* is received in the hinge pin socket **22** of the device **20**. It is also preferable to position a friction-reducing cup **37** around the bottom of the hinge pin **36** which can rotate relative to the enlarged shoulder portion **36***b*. Because the entire weight of the door **14** is transmitted to the bottom surface of shoulder **36***b*, and this weight is then borne by the annular hinge pin socket seating surface **21**, the friction-reducing cup **37** provides a desirable reduction in friction between the relative rotating surfaces; however, this is not a limitation on the present invention. At the very end of the torque rod **32** and integral therewith is a hexagonal head **38** which mates with the device **20** in such a way that the torsion of the torque rod can be adjusted. Although a hexagonal shape is disclosed as the preferred embodiment, any shape or means that can lockingly mate with the worm wheel to be hereinafter described can be employed (e.g. any non-circular shape).

In a preferred embodiment, the device **20** includes a base member **50**, a cover **60**, an intermediate member **70**, a torque adjustment mechanism **71** for adjusting the torque of the torque rod, and a lateral adjustment mechanism **73** for adjusting the lateral position of the hinge pin socket.

The base member **50**, best seen in FIG. **5**, is intended to fixedly attach the device **20** to the cabinet **12**. In order to utilize the orifices presently found in some cabinets which use a conventional anchor socket, the base member **50** is provided with four legs **51** which seat in the four mating recesses **53** circumferentially spaced about the edge of aperture **54**. Once the base member **50** is positioned over the aperture **54** it cannot move laterally relative to the cabinet **12**, nor rotate in the aperture **54**. In order to prevent the base member **50** from lifting out of the aperture **54**, the following method of assembly is used. The base member **50** is provided with a centrally located and downwardly-protruding nipple **55** having a rivet receiving orifice **56** therein and a screw head rivet **57** is inserted through the rivet-receiving orifice **56** from above and is further inserted into the receiving orifice of a locking element **58**. This locking element **58** is flat and has four circumferentially spaced protrusions and is shaped so that it can mate with but pass through the aperture **54**. As seen in FIG. **2**, the base member **50**, the rivet **57**, and the locking element **58** are attached to each other. FIG. **2** shows rivet **57** with its end **57***a* flattened so as to retain the locking element **58**. The rivet **57** is sized so that it is tightly received by the orifice in the locking element **58** so that the locking element **58** can be rotated by turning the rivet **57**. When installing the base member **50**, the locking element **58** is rotated so that its protrusions **58***a* rest on the legs **51** integral with the base member **50**. This positioning allows the locking element **58** to pass through the aperture **54** when the base member **50** is lowered onto the cabinet **12**, then by turning the rivet **57**, the locking element **58** is rotated and the protrusions **58***a* now are locked behind the underside of the cabinet **12**, thereby preventing withdrawal of the base plate **50** from the cabinet **12**.

As is shown in FIG. **5**, the intermediate member **70** includes a female dovetail chamfer **72** that mates with a male dovetail chamfer **74** on the base member **50** (see FIG. **7**), to prevent the intermediate member **70** and cover member **60** from moving upwardly, but that allows the intermediate member **70**, cover member **60** and associated components to move laterally so that the sag or position of the hinge pin socket can be adjusted.

In a preferred embodiment, the cover **60** is attached to the intermediate member **70** via pins **76** that are press fit into openings **70***a* and **60***a* in the intermediate member **70** and cover member **60**, respectively. It will appreciated that other methods for connecting the intermediate member **70** and cover member **60** are within the scope of the present invention. The cover member **60** serves at least two functions: (1) it provides a socket for the bottom hinge pin **36**; and (2) it provides an anchor for the bottom end **38** of the torque rod **32**. The cover **60** is provided with a recessed annular seating surface **21** which is circular and sized to mate with the hinge pin **36** and to allow it to rotate within the socket. A torque rod orifice **24** is provided in the center of the hinge pin socket **22** sized to receive the hexagonal head **38** at the end of the torque rod **32**.

In a preferred embodiment, the torque adjustment mechanism **71** comprises a worm gear mechanism that is housed between the cover **60** and the intermediate member **70**, and comprises a worm wheel **26** and a worm **28**. The worm wheel **26** is positioned adjacent to the surface **25** which is the underside of the hinge pin socket seating surface **21** and the upper surface **27** of the intermediate member **70**. The center of the worm wheel **26** has an aperture **26***a* which is shaped to matingly receive the hexagonal head **38** of the torque rod **32**, such that the worm wheel **26** and the bottom end of the torque rod are rotatively engaged. The upper surface **27** of the intermediate member **70** is adapted to shield the rotating worm wheel **26** from extraneous parts and to hold it in position. The worm **28** is housed in a channel **29** in intermediate portion **70** (that has a mating portion defined in the cover **60**) and includes screw heads **28***a* on opposite ends thereof that extend through worm openings **78** in the cover **60** and includes a gear portion **28***b*. The worm **28** is disposed perpendicularly to the lateral extension of the cabinet **12** so that the screw heads **28***a* on the ends of the worm **28** are accessible to a screwdriver or other implement for turning. It can therefore be seen that by turning the worm **28** the worm wheel **26** is rotated which rotates the hexagonal head **38** of the torque rod, and thereby allows fine and continuous adjustment of the torque rod.

Turning our attention now to the hinge pin socket lateral adjustment mechanism **73**, it is frequently desirable to adjust the lateral position of the hinge pin socket **22**, either to the left or to the right (from the perspective of facing the door) to vary the angle of the door's pivot axis to compensate for any sag or misalignment in the door.

The hinge pin socket lateral adjustment mechanism of this invention is provided for in a preferred embodiment in a manner to be now described. The base member **50** is provided with an angular slot **52** defined therein. The intermediate portion **70** is provided with two flanges **80** that each include an indentation **80***a* defined therein and that define a space **80***b* therebetween. An adjustment screw **65** with two heads **65***a* on opposite ends thereof, two non-threaded portions **65***b* and a threaded portion **65***c* is provided. The adjustment screw **65** is positioned on the intermediate portion **70** such that the non-threaded portions **65***b* rest in indentations **80***a* and the threaded portion **65***c* spans space **80***b*. The heads **65***a* extend through screw openings **82** in the cover **60**, which are preferably positioned adjacent worm openings **78**. The threaded portion **65***c* of the adjustment screw **65** includes a peg nut **84** received thereon. The peg nut **84** has a boss **84***a* extending therefrom that extends through and is captured by angular slot **52**. In an embodiment, the screw **65** can be provided with a lock nut that is disposed around the screw **65** on the inside

surface of the cover **60**. This lock nut serves to prevent the screw **65** from moving relative to the cover **60**.

In use, when the lateral adjustment screw **65** is rotated by turning the screw head **65***a*, the threaded engagement of the screw **65** with the peg nut **84** causes the peg nut **84** to move axially along the screw **65**. As a result of the axial movement of the peg nut **84**, the boss **84***a* bears against the bearing surface **52***a* of the angular slot **52**. Because the base portion **50** is anchored to the frame **12**, the action of the boss **84***a* bearing against bearing surface **52***a* causes the intermediate portion **70** and cover **60** to move longitudinally (or side to side with respect to the door), thereby changing the lateral position of the hinge pin socket **22**.

Unless the context clearly requires otherwise, throughout the description and the claims, the words "comprise," "comprising," and the like are to be construed in an inclusive sense, as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to." As used herein, the terms "connected," "coupled," or any variant thereof, means any connection or coupling, either direct or indirect, between two or more elements. Additionally, the words "herein," "above," "below," and words of similar import, when used in this application, shall refer to this application as a whole and not to any particular portions of this application. Where the context permits, words in the above Detailed Description of the Preferred Embodiments using the singular or plural number may also include the plural or singular number respectively. The word "or" in reference to a list of two or more items, covers all of the following interpretations of the word: any of the items in the list, all of the items in the list, and any combination of the items in the list.

The above-detailed description of embodiments of the disclosure is not intended to be exhaustive or to limit the teachings to the precise form disclosed above. While specific embodiments of and examples for the disclosure are described above for illustrative purposes, various equivalent modifications are possible within the scope of the disclosure, as those skilled in the relevant art will recognize.

Any patents and applications and other references noted above, including any that may be listed in accompanying filing papers, are incorporated herein by reference in their entirety. Aspects of the disclosure can be modified, if necessary, to employ the systems, functions, and concepts of the various references described above to provide yet further embodiments of the disclosure.

These and other changes can be made to the disclosure in light of the above Detailed Description of the Preferred Embodiments. While the above description describes certain embodiments of the disclosure, and describes the best mode contemplated, no matter how detailed the above appears in text, the teachings can be practiced in many ways. Details of the system may vary considerably in its implementation details, while still being encompassed by the subject matter disclosed herein. As noted above, particular terminology used when describing certain features or aspects of the disclosure should not be taken to imply that the terminology is being redefined herein to be restricted to any specific characteristics, features or aspects of the disclosure with which that terminology is associated. In general, the terms used in the following claims should not be construed to limit the disclosures to the specific embodiments disclosed in the specification unless the above Detailed Description of the Preferred Embodiments section explicitly defines such terms. Accordingly, the actual scope of the disclosure encompasses not only the disclosed embodiments, but also all equivalent ways of practicing or implementing the disclosure under the claims.

While certain aspects of the disclosure are presented below in certain claim forms, the inventors contemplate the various aspects of the disclosure in any number of claim forms. For example, if only one aspect of the disclosure is recited as a means-plus-function claim under 35 U.S.C. §112, ¶6, other aspects may likewise be embodied as a means-plus-function claim, or in other forms, such as being embodied in a computer-readable medium. (Any claims intended to be treated under 35 U.S.C. §112, ¶6 will begin with the words "means for"). Accordingly, the applicant reserves the right to add additional claims after filing the application to pursue such additional claim forms for other aspects of the disclosure.

Accordingly, although exemplary embodiments of the invention have been shown and described, it is to be understood that all the terms used herein are descriptive rather than limiting, and that many changes, modifications, and substitutions may be made by one having ordinary skill in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A device for use in a door assembly that is positioned in a cabinet and defines a pivot axis, the device comprising:

a base member adapted to be fixedly secured to the cabinet, wherein the base member includes a diagonally oriented slot defined therein,

an intermediate member slidingly engaged with the base member, wherein the intermediate member includes a transversely extending adjustment screw associated therewith that defines an axis and has at least one head and a threaded portion with a peg nut thereon, wherein the peg nut includes a boss extending downwardly into the diagonally oriented slot of the base member,

a cover connected to the intermediate member and having a hinge pin socket therein, wherein the cover includes an opening defined therein through which the head of the adjustment screw extends,

wherein rotation of the adjustment screw causes the boss to move along the diagonally oriented slot which causes the intermediate member and the cover to move in a direction substantially perpendicular to the adjustment screw axis.

2. The device of claim **1** wherein the adjustment screw includes two non-threaded portions positioned axially on either side of the threaded portion, and wherein the non-threaded portions each are seated in an indentation defined in the intermediate portion.

3. The device of claim **2** wherein the adjustment screw includes a head on each end thereof, and wherein the cover includes openings on each side thereof through which one of the heads of the adjustment screw extends.

4. The device of claim **1** wherein the intermediate member and base member comprise mating angled surfaces that prevent the intermediate member from moving upwardly and that allow the intermediate member and cover to slide in the direction substantially perpendicular to the axis defined by the adjustment screw.

5. The device of claim **1** further comprising a worm wheel rotatively housed in the cover and having a central aperture adapted to matingly receive the end of a torque rod of the door assembly in a non-rotative relationship; and a worm housed by the cover in engaging relationship with the worm wheel and adapted to be selectively turned so as to adjust the torque of the torque rod.

6. The device of claim **5** wherein the worm is seated in a channel defined in the intermediate member.

7. The device of claim **1** further comprising a torque adjustment mechanism that is adapted to adjust the torque of a torque rod of the door assembly.

8. The device of claim **7** wherein the torque rod adjustment mechanism includes a worm and a worm wheel, wherein the worm is rotatable about a second axis that is substantially parallel to the adjustment screw axis.

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